COMPUTERS
and AUTOMATION

DATA PROCESSING • CYBERNETICS • ROBOTS

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IMPORTANT APPLICATIONS OF COMPUTERS

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SOME IMPORTANT APPLICATIONS OF COMPUTERS

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Readers' and Editor's Forum

FRONT COVER: RAPID RETRIEVAL

The tiny segment of magnetic tape contains file numbers of 500 documents stacked beside the young lady. One complete tape holds more than 250,000 file numbers, which the new retrieval system at General Electric, Cincinnati, can search in less than three minutes. Up to 99 searches can be performed simultaneously, greatly reducing time and cost over old methods.

COMPUTER GLAMOUR

The *Wall Street Journal* of March 6, 1958, published an article headlined "Computers' Glamour Wears Thin as Some Firms Find Savings Disappointing; Makers See Selling Tougher."

Business Week of June 21, 1958, published an eight page special report entitled "Computers," saying among other things "Computers are no strangers in business today . . . Their real potential has been snagged in false starts and mistakes in use . . ." The report is excellent and interesting, and is available for 50c from Reprint Department, Business Week, 330 West 42 St., New York 36, N.Y.

Do computers have glamour? Yes, there is no doubt that they do. A computing speed of 10,000 arithmetical operations per second most certainly has glamour.

Is it easy to make mistakes in applying computers? Yes, it is always easy to make mistakes in applying anything. Human beings make a specialty of making mistakes; and the difference between most human beings and some human beings is that most human beings make the same mistake more than once but some human beings make a mistake only once — they learn the first time, just as a computer when suitably programmed also learns the first time.

Automatic digital computers, incidentally, are among the most accurate and reliable machines that have ever been made, with 10^7 to 10^9 operations between errors. And, of course, if properly instructed, a computer can learn — or in other language, if a computer is properly programmed, and arrives at a branch point in a program, it can choose the proper branch, and record the choice for future reference.

Why then do many people have trouble applying computers adequately in business? Some of the reasons are mentioned in the *Business Week* article. One is "war of the generations" — older more conservative management versus younger more enthusiastic management. Another is the problem of "empire," as in dealing with the vested interests of a fifty-year old department of work in a large life insurance company. Also there is the problem of just plain lack of imagination, failure to see many sides, among the people who have to work out the details of a new system, because the new system is a big one, a group of different people on a committee have to work together, some of them have much less imagination than the others, and the composite report they produce takes a middle position that has insufficient grasp of all the implications, and so is one-sided. But these reasons stem from properties of human beings, not of computers.

Even among well-informed people and well-informed reporters, one-sidedness appears sometimes in what they say or think. For example, the *Business Week* report says "So-called small or baby computers with rather limited application can run below $100,000" a year, the clear implication being "not much below." But if a businessman really wants to keep expenses down, he can take one or two certain specially suitable problems to a computing service, and pay only for the work done — and for some of these problems he would certainly be able to get some substantial benefits from automatic computing for less than a $1000 one-time cost. An example is a livestock feed formula (see the report in this issue).

One-sidedness in looking at something, as revealed also in the phrase "computer glamour wearing thin," is a very human failure. One of the hardest of all processes for a human being is to look at all sides of something and evaluate them properly. He needs to ask over and over the questions "What have I forgotten to consider? What are the important ramifications of this that so far I have not thought about?"

The need to look at all sides of a situation is presented in a game of chess, where two players confront each other, every piece out in the open, nothing concealed. Yet one of the players is relatively more efficient in seeing and remembering possibilities and in evaluating them, and so he is able to defeat the other player.

Is the avoidance of one-sidedness, the training to look at all sides of something, an intellectual procedure? Yes, it is. It requires building up from experience or books or observations a long checklist of points to be considered, and then using a process of analyzing their implications and evaluating them — just as in chess.

And just as the procedure of seeing and weighing all sides of something, can be trained into an intelligent human being, so the procedure can be performed by automatic computers, properly programmed. Problems that resemble this are being run or being prepared for running on computers right now: playing chess; diagnosing a disease by its symptoms; translating from one language to another; evaluating statements for their consistency; etc.

To say "computer glamour wearing thin" on the basis of mistakes by human beings in applying computers is one-sided. It is like judging the importance of automatic computers on the basis of only the fourteen years of their existence from 1944 (the year of operation of the first modern automatic digital computer — the Harvard IBM Automatic Sequence Controlled Calculator). Such judgment leaves out of account any estimates regarding the hundreds of years of application of automatic computers that lie ahead of human beings — if only this world of ours is not destroyed by the dread threat of the combination of: (1) nuclear warheads; (2) intercontinental ballistic missiles; (3) automatic computing and control devices; and (4) present day human behavior.

EASTERN JOINT COMPUTER CONFERENCE — PHILADELPHIA, PA. — DEC. 3-5, 1958

THE 8TH ANNUAL Eastern Joint Computer Conference and Exhibition will take place in Philadelphia at the Bellevue Stratford Hotel, on Wednesday to Friday, December 3 to 5, 1958. The theme of the conference is:

[Please turn to page 25]

SOME IMPORTANT APPLICATIONS OF COMPUTERS

RAPID RETRIEVAL OF INFORMATION

Bernard K. Dennis
Manager, Technical Library
General Electric Co., Aircraft Gas Turbine Div.
Cincinnati, Ohio

AN AUTOMATIC INFORMATION retrieval system that searches out written information 1000 times faster than a man can do it has been developed and placed in operation for the technical library at General Electric's Aircraft Gas Turbine Division in Cincinnati, Ohio.

We consider that this may be the forerunner of a vast network of similar devices linking every technical data center in the nation.

The automatic information retrieval system is designed to aid engineers and scientists in conducting a search for written information on a given subject. Without such information, the engineer or scientist would often have to design and perform an experiment, usually very expensive, to learn something that might already have been done and recorded by some other person.

What the system may do to reduce the staggering cost of research and development in the United States by increasing the efficiency of technical personnel, and by avoiding duplication of scientific effort, is difficult to estimate. But if the efficiency of all technical personnel engaged in research and related work were increased in 1959 by just one-tenth of 1 percent, it could save the United States over $6,000,000.

The new system is based on the use of descriptive key words and document file numbers. All technical documents in the AGT Library are carefully identified in terms of these key words. Each document may have a dozen or more words to describe it; all documents pertaining to the same subject will be listed by number with these terms. In addition, a concise, descriptive abstract is prepared for each document in the system.

All this information is transferred to a series of magnetic tapes for use in the electronic computing equipment, located in the same building with the Library. At present there are more than 30,000 document abstracts recorded on just three tapes; there are over 7000 key words describing these documents; and there are more than one-quarter million document file numbers coordinated with the words in the system.

The retrieval system, using IBM 704 computing equipment, can search through the entire list of numbers in less than three minutes. And in less than 15 minutes, the time depending on the number of documents found during the search, the system will deliver printed abstracts of those documents. Each abstract carries the requestor's name and address, the document's title, author, and file number, and the security classification of the material.

Here is a sample of a report delivered by the system, line by line as printed by the high-speed printer:

```
                R. B. JOHNSON
                BUILDING 305
                FPLD
  ACCESS NUMBER 017911
  REPORT NUMBER PICATINNY TR 2254
           DATE 05/  /56
        AUTHORS PRISTERA, F.
        TITLE AND ABSTRACT
ANALYSIS OF EXPLOSIVES BY INFRARED SPECTROSCOPY.
COMPILATION OF 68 INFRARED SPECTROGRAMS COV-
ERING ALL COMMON HIGH EXPLOSIVE COMPOUNDS
AND MANY HIGH EXPLOSIVE INGREDIENTS, ADDI-
TIVES, AND RELATED COMPOUNDS
PREPARED BY. AIRCRAFT GAS TURBINE LIBRARY
SYSTEM
```

Before the system was put into use, an average literature search by trained personnel required as much as 14 hours.

Reid Barton and Lee Caplan, designers of the computer program, explain that in its present form the system can accommodate 1,000,000 abstracts, 56 million file numbers, and can perform up to 99 simultaneous literature searches. Barton adds: "New computing equipment is available which could increase the speed of our present system by 1000 percent, while the document storage capacity would be around 10,000,000."

The need for additional speed and storage capacity may not be far in the future. Reliable estimates show that well over 2 million technical documents were published in the world in 1957. And statistics indicate that the rate of output will double every 10 years.

To the engineer or scientist at General Electric, in less than an hour, the new system means that he can learn what has been written and is available on a particular subject, and at a greatly reduced cost. Both time and cost depend on the complexity of the search and on the number of searches performed simultaneously.

As the number of documents in the system grows, the more thorough the search. The more thorough the search, the more the system will be used. And the more it is used, the more economical each search becomes.

Our system performs even better than we had hoped. But it is only the first step in automatic literature searching. We visualize that within the next 10 or 20 years the nation's entire industrial community will be tied together through a network of sophisticated automatic

retrieval systems. Published data from other industries, government agencies, and educational institutions will be made available to the inquiring engineer merely by feeding questions into an electronic searching system at his place of work.

These questions we believe will be channeled to all the technical data centers in the network. At each center an automatic retrieval system, probably resembling ours, will search through all the documents available. They will then transmit the material back through a filtering center, which will eliminate duplicates of documents, and forward the information to the waiting engineer.

AN ELECTROMECHANICAL LETTER-SORTING MACHINE

AN ELECTROMECHANICAL letter-sorting machine that can handle more than a quarter of a million pieces a day, has been installed at the City Post Office, Washington, D.C., and accepted by the U.S. Post Office.

This is a semi-automatic machine which permits each of six clerical operators, sitting at keyboards, to sort 3,000 letters to 300 destinations every hour. It is being used to sort mail from the Washington Post Office to all principal cities in Virginia and many states throughout the country.

The machine is built within a large tubular frame and contains an endless chain of 626 transport boxes that pass successively by each of 300 destination cases. Six operating desks are each equipped with an operator's coding keyset and an inclined loading ramp on which mail coming in to the operator is stacked. The letters pass on a belt in front of the operator. The operator presses a key to direct each letter to its destination case. If the operator realizes that she has punched the wrong code, she has three seconds to pick up the letter and remove it from the belt taking the letter into the machine. If she finds an illegible address, she directs it to a special destination case.

The letter sorter was developed by the Bell Telephone Manufacturing Company, Antwerp, Belgium, a Belgian subsidiary of International Telephone and Telegraph Corp., which introduced the machine to this country. The letter sorter was in experimental operation for several months prior to its final official acceptance by the U.S. Post Office Department.

WEAPON EVALUATION BY COMPUTER SIMULATION

Carl Friedman

Technical Operations, Inc.
Burlington, Mass.

TECHNICAL OPERATIONS, INC., has for the past several years been engaged in the design of war games for evaluation of weapon systems. As the variety of weapons has increased, the need for a general technique for evaluating these weapon systems has become apparent and vital. This note seeks to describe a digital computer program which we feel is a first step in the direction of improving our evaluating techniques.

A simulated war game can be described as follows:

1. *Rules of Play.* This includes specific rules for target acquisition, firing, maneuvering, etc., and determining the end of the game.

2. *Weapon Characteristics.* A weapon can be described

by specifying various statistical parameters: standard deviations of firing dispersion; dimensions of weapon; minimum and maximum ranges of fire; kill probability distributions; time delay distributions; cones of fire.

3. *Environment.* This includes terrain features such as the extent of boundaries in which the game is to be played, natural topographic data such as hills, gullies, etc.

4. *Statistical rules* for computing kill probabilities and time delays.

5. *Decision Maker.* This is invariably a pseudo-random number compared with a probability to give a yes or no decision.

6. *Statistical Analysis.* Each game is played many times, and statistical quantities such as average number of kills, average number of shots fired, standard deviation of kill, standard deviation of the number of shots fired, etc., are computed. Standard statistical tests are made, usually analysis of variance, to determine the effect of the weapon being evaluated.

The computer program is designed to assemble highly flexible input data. The degree of generality built into the program implies that the preparation of input data is burdensome; however, by the same token, this generality enables the user to play a variety of games such as tank vs. antitank; infantry vs. infantry; anti-aircraft vs. bombers, etc.

The main functions of the program are:

1. *Input assembly program.* The input assembly program reads mnemonic code, assigns addresses, and assembles data into tabular form for computer use.

2. *Control and initiating program.* The Control and initiating program serves as the master control and central processing agent. Here main bookkeeping functions are performed such as number of games played, game time, halt, etc. The key to the processing is an "action time." Each weapon is initially set in a variety of initial states and a series of random time delays are assigned to each weapon for a "next action time." These time delays are then sorted for the smallest "action time" and this action is then performed by "switching" the weapon to the appropriate subroutine. "Action time" is defined quite generally; it can be one of several actions which can be performed such as: time to look for a target; time to fire; time to die by artillery or mine kill perhaps; time of death by opposing weapon; time for an evasive maneuver; time to change firing status or cone of fire; and time for general changes in status such as stopping, being obscured by smoke, becoming non-visible, etc. (some action times are not random time delays but are specified by input data.)

3. *Rules of play program.* The rules of play program is a "plugboard" in the sense that it is designed so that changes in logic can be made by interchanging subroutines. The rules of the game are set down as sequential binary decisions, and can include such concepts as firing modes, overriding tactical plans on the basis of some condition of the "random" situation, etc.

4. *Target selection program:* In a live war game a weapons director usually assigns targets to his battery or to his interceptors on the basis of the tactical situation. The program attempts to simulate the various modes of target assignment by rules.

In the program, target assignments are made on the basis of two main categories: fixed subgroups; random subgroups.

The fixed subgroup enables a weapon to acquire and fire at targets if these targets are acquirable in a fixed order, i.e., target one will be acquired first, target two next, etc.

The random subgroup enables the weapon to make a random choice from one of several targets presented.

Changes in target selection categories can be made during the game as specified by the input data.

5. *Log preparation program:* The program prepares a log of action which gives a complete history of the actions of the game. This log is stored on tape in binary coded decimal form for direct or delayed print-out as desired.

6. *Log analysis and output program:* The log analysis program is a general print-out and statistical routine. The user may specify the kinds of information he desires; for example, in a tank vs. antitank game it may interest him to know how many successful pinpoint hits "red side" made. The program then analyzes the log and records the desired information. The log analysis can also record statistical data such as averages, variances, etc. It is planned, although not included at present, to build into the program more complicated statistical tests such as analysis of variance. At present this is done by hand computation.

As previously mentioned, the computer program is modular in form so that additions, revisions, and deletions in program structure can be made easily. The program is designed for the IBM 704 computer. It requires about 4000 instructions plus three tape units which contain the input program, game program, and log analysis program. A fourth tape is used for storing the logs of many games. Running time is difficult to approximate since the size of the games vary considerably from game to game. The programs are read in when needed by the control program.

These war games make it possible to test existing and proposed weapons systems in the simulated environment of possible future war.

AUTOMATIC DIGITAL RECORDING AND TRANSLATING ON PHOTOGRAPHS

Thomas C. Flynn

International Telephone and Telegraph Corp.
New York, N.Y.

AN AUTOMATIC DEVICE for writing captions on photographs has been produced, by photographing simultaneously a pattern of dots on the face of a one-inch cathode ray tube located in the camera's field of vision. The purpose which led to its development was a requirement of the Wright Air Development Center, Air Research and Development Command, U.S. Air Force, in aerial photography. As the aerial camera turns, location, speed, altitude, and other pertinent data are automatically recorded from the cathode ray tube report onto a film area no larger than the head of a tack. During development of the film, the ground-based portion of the Recording Device automatically decodes and prints the information in numerical form directly below the photograph.

The device is called the Digital Data Recording Device, and was developed by International Telephone and Telegraph Laboratories, Nutley, N.J., the research division of the International Telephone and Telegraph Co.

The device appears to have all the earmarks of a new and important application of digital and computing techniques, since whatever a camera sees can now be combined with a digital recording that expresses any

Position, altitude and other pertinent data necessary to U.S. Air Force reconnaissance may be recorded automatically on photographs with a device produced by International Telephone and Telegraph Laboratories, Nutley, N.J., research division of International Telephone and Telegraph Corp. The device, known as the Digital Data Recording Device, records all information in coded-dot form (lower-right) directly on the photograph. During development of the film, a ground-based reader decodes and prints the data beneath the picture (bottom). Commercial applications envisaged for various portions of the Recording Device range from library cataloguing to industrial automation. (Note: This photograph of lower Manhattan has no relation to the coded information shown, which is simply illustrative.)

information implied in the directing and timing of the camera. Of course, this device does not include "recognizing" of anything that the camera sees.

AUTOMATIC READING OF THE SHAPE OF CHARACTERS BY ELECTRONIC MEANS

CHARACTERS IMPRINTED ON accounting stubs or stubs are being read automatically by electronic means. A device that does this is made by Intelligent Machines Research Corp., Arlington, Va., and is called the "Eye."

First, accounting statements with cashier's stubs are printed in a conventional way by an IBM 407 tabulator, but using special typewheels in a new type face called IMR SELFCHEK. This typeface is entirely legible to human beings, but has a slightly squarish appearance; it has been designed for properties of maximum reliability and maximum checking.

Second, the printed cashier stubs are used in the normal way in the field, and paid by customers, either by mail or in banks or grocery stores or other authorized collection points. If a different amount is paid, the cashier lines through the printed amount, and enters the amount actually paid in ordinary writing. Such a stub is routed by the machine for manual attention. But the great bulk of stubs, for which the printed information is unchanged and is correct, are sent, together with a tape of payments received, to a central accounting office for processing.

At this point, the "Eye" character sensing system comes into play. It has three major components, the Scanning Stub Feed, the Interpreter, and the Output Punch.

The Scanning Stub Feed passes the stubs before a scanner one at a time. After scanning the stubs are sorted into accept or reject pockets, depending on the results of the scanning and the checking of it. For accepted stubs, the scanner produces a stub image in video signals.

The video signals are analyzed by the Interpreter (a small special purpose digital computer), which identifies the signals according to the letter and the combinations of strokes or lines which make up the letter. Then each character is stored until the whole stub is read. Then all the characters, both regular and special and manually set constants, are punched into an IBM punch card by an IBM summary punch, Type 523, operating at its regular speed of 100 cards a minute.

A REINFORCED CONCRETE BUILDING DESIGNED BY AN AUTOMATIC COMPUTER

Eve Peasner

**The Datics Corp.
Fort Worth, Texas**

A MODIFIED Hardy Cross method of distribution has been successfully used in the development of a program to analyze building frames. Specifically, the modified system is that developed by Professor L. E. Grinter and further standardized by the Portland Cement Association; this method records the signs of the moments automatically and can be distributed to as many iterations as necessary. The program was developed in cooperation with W. C. Kruger and Associates, architects and engineers, Santa Fe, N.M., was supervised by Mr. James Mahoney, U.S. Corps of Engineers, and computed by the Datics Corporation.

The building in question was a two-story reinforced concrete frame building for the Albuquerque District Corps of Engineers, designed to house an analog and a digital computer at an Air Force installation.

The data supplied to the computer were the K factors of all members, their fixed end moments, and the uncorrected shear of each beam, plus the C factors for the two-way slabs as specified in the current ACI code, Section 709 Method I. The design strength of the concrete and reinforcing is established by the engineer. Although the computer could supply the fixed end moments and the uncorrected shears from the loads involved, it was felt that these factors were properly in the sphere of the designing engineer. His judgment is required for unusual or concentrated loading and other intangible factors inherent in nearly every design.

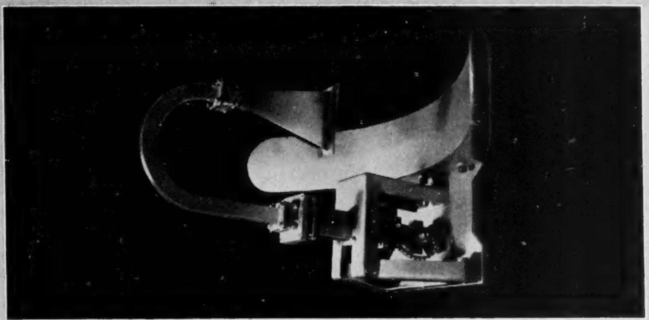
The answers supplied by the computer were corrected design moments for all members including reduction for columns, corrected shears, and the area of reinforcing required for both positive and negative moments. The computer checked the size of each member for compressive strength prior to designing the reinforcing. To do this, it selected the largest moment in the beam for checking. If the member is adequate, it is designed for the estimated size furnished originally. If the size of the member is appreciably affected, the K factors are automatically adjusted. Although members could be designed exactly to size, most designers prefer to maintain some uniformity in size for economy in forming, especially with regular base and loadings.

The same calculations, performed manually, would have taken some ten working days by competent engineers. Now that the program is complete, it is estimated that jobs of similar magnitude can be completed in a few hours' time. The method as programmed is very flexible, and can be used for almost any normal concrete frame whose arrangement lends itself to analysis by the Hardy Cross method. Also, it could readily be adapted to continuous steel frames by the introduction of the proper K factors and fixed end moments.

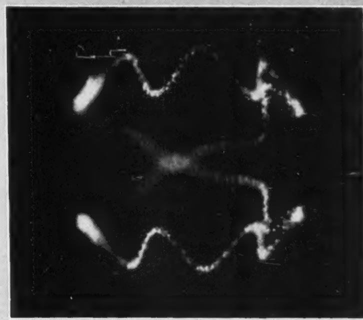
AN AUTOMATIC ANALYZER OF INFRARED SPECTRUM TO IDENTIFY CHEMICALS

SCIENTISTS OF THE Sloan-Kettering Institute for Cancer Research, New York, N.Y., in the earlier stages and engineers of International Telephone and Telegraph Laboratories, Nutley, N.J., in the later stages have devised an automatic electronic analyzer of the infrared spectrum of chemical mixtures. The pattern of absorption of infrared waves for a chemical is as unique as the pattern of markings in a fingerprint for a human being.

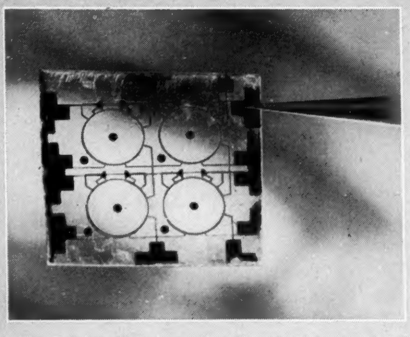
The spectroanalyzer system consists of a number of units. The first is a source of infrared radiation which sends out almost the entire infrared spectrum. The second unit is a spectrophotometer which measures the respective absorptions of the chemical fluid or mixture being analyzed, and reports the absorptions at various wavelengths in numerical form on punched paper tape. The third unit is a "library" containing the absorption pattern for various infrared wavelengths of known chemicals, which are possible constituents. The fourth unit is an electronic com-



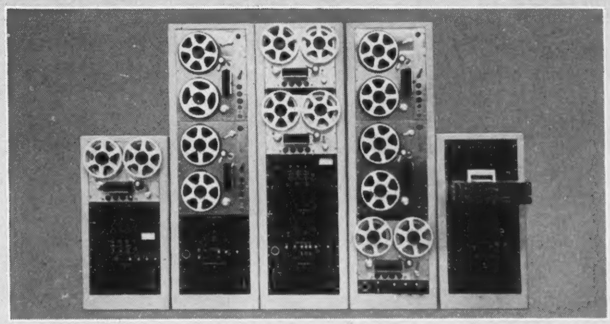
Horn fed parabolic reflector antenna for airborne applications.



Charged aluminum particle suspended and controlled in a vacuum chamber by an oscillating electric field.

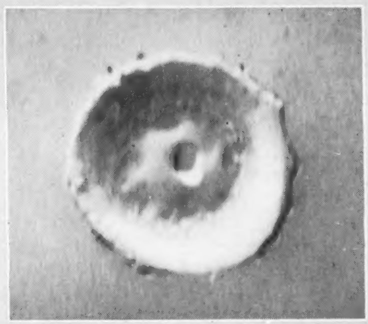


The Persistor gives promise of cryogenic computer memories with a capacity of 1,000,000 bits per cubic foot and access times of 1/30 microsecond.



Ground based data handling equipment for processing analog and digital reconnaissance information.

Data conversion system for digitizing and processing telemetered missile test data.



Electron micrograph of impact produced on aluminum coated glass by a 1 micron diameter particle traveling at 7,000 feet per second.

Pictorial **PROGRESS REPORT**

The photographs above illustrate some of the recent research, development, and manufacturing activities at Ramo-Wooldridge. Work is in progress on a wide variety of projects, and positions are available for scientists and engineers in the following fields:

- Digital Computers and Control Systems
- Communications and Navigation Systems
- Guided Missile Research and Development
- Infrared Systems
- Electronic Countermeasures
- Electronic Instrumentation and Test Equipment
- Basic Electronic and Aeronautical Research

The Ramo-Wooldridge Corporation

LOS ANGELES 45, CALIFORNIA

puter which makes automatic comparisons between the known patterns and the unknown pattern, performs mathematical calculations, and gives the quantitative analysis of the chemical sample being examined.

Mixtures with up to 10 constituents can be analyzed easily, since the spectroanalyzer uses the entire infrared spectrum of the mixture in a high speed electronic matching technique. The older method matched spectra at just a few wave lengths. The greater sensitivity of the new device makes it invaluable where only a trace of a constituent exists.

The device does in minutes analyses that formerly required days and sometimes weeks. It also analyzes the quantity of hormones in chemical mixtures so complex that they would not ordinarily be analyzed by older methods of infrared spectroscopy because the time required would be prohibitive.

Besides the analysis of chemical mixtures of a kind that cancer research investigates, the device is expected to have numerous applications in chemical, petroleum, pharmaceutical, and nuclear research in the future. Its speed will serve to make scientific manpower more effective by freeing researchers from time-consuming techniques in chemical analysis. For nuclear research, the spectroanalyzer can be adapted to identify radioactive isotopes by the patterns of number of electrons or waves given off, an identifying mark as certain as the degree of infrared absorption.

THE LARGEST SINGLE ELECTRONIC DATA PROCESSING SYSTEM IN ANY BANK

A NEW ELECTRONIC data-processing system started working in The First National Bank of Boston on July 29. Designed, built, and installed by the Datamatic Division of the Minneapolis-Honeywell Regulator Company, it is the largest single electronic system currently in any bank in the world.

In 1957, the bank processed approximately 47 million of its customers' checks; by 1960 it is estimated that the figure may be 54 million. Each check is handled on an average of slightly more than 4 times. This totaled approximately 197 million handlings in 1957 and could grow to 226 million in 1960. It is expected that electronic data processing will help the bank adjust to this expected volume, and will result in greater accuracy, speed and efficiency in many banking operations.

The first program being processed on the Datamatic 1000 concerns the records of 30,000 special checking accounts. When punch card checks reach the bank for payment, they are coded for the amount and fed directly into the system, which will post them to the accounts at high speed. Later, regular checking accounts for 70,000 depositors will also be processed electronically, when equipment is received which will automatically read information printed on each check in special magnetic ink.

In addition to deposit accounting, other applications programmed or being prepared are the maintenance of stockholders' ledgers, preparation of dividend checks for the Corporate Trust Division, and loan accounting, including instalment, commercial, mortgage, and factoring loans. Personal trust accounting and payroll accounting applications are under study.

All master files of departments in the bank that will use the system initially will be condensed onto 20 reels of the special magnetic tape. Each of these reels, about 20 inches in diameter, contains more than half a mile of tape. As an example of its capacity, each reel is capable of storing the names, addresses and telephone numbers in both the Boston and Springfield telephone directories. One storage cabinet covering five square feet will hold tapes containing all the data previously requiring 2,185 square feet of bank space.

The system "reads" and "writes" at the rate of 60,000 decimal digits per second, while at the same time performing 1,000 multiplications or 4,000 additions or 5,000 comparisons.

INVENTORY BY AUTOMATIC DATA PROCESSOR IN A MILITARY MEDICAL SUPPLY DEPOT

H. Hulsey

Louisville Medical Depot
Louisville, Ky.

THE DEPARTMENT OF Defense desires to reduce the cost of accounting operations and manpower, to increase efficiency for worldwide supply of medical equipment, and to increase mobilization potential for the requirements of the nuclear age. Accordingly, the Department established a pilot program to determine the capabilities and limitations of electronic data processing equipment in performing all accounting functions normally performed by a supply depot. The Louisville Medical Depot, Louisville 1, Kentucky, was selected as the site of the test program. The test of Random Access Memory Accounting Machine equipment was begun in the spring of 1957. The results of the test program were successful; and so the production model, IBM RAMAC 305, was put into use March 15, 1958, and has worked excellently.

Approximately 398 acres of Government-owned land, of which 209 acres are the operational area, comprise the Louisville Medical Depot. There are 14 miles of vehicular road and 11 miles of railroad track, concentrated primarily in the operational area. There are 45 temporary and semi-permanent type buildings and six permanent type buildings, with a valuation of about $5.3 million.

Over 40 acres of warehouse space, containing mountains of medical supplies, and workshop areas buzzing with activity have a single purpose — providing medical supplies when and where they are needed to help maintain the health of military personnel throughout the world.

Under the joint plan put into effect in 1957 by the Defense Department, all military activities within designated areas order their medical supplies from the depot, much as a retailer orders supplies from a wholesale house.

One of the biggest jobs at the depot, is the assembly of field hospitals. All the medicines and equipment needed for housing and treating patients will be found in an assembly — from aspirin to tents. Hospital units as large as 1,000 bed capacity are assembled. They are packed in sterile coverings and crated, boxed or wrapped to withstand weather and rough handling. Stacked on warehouse floors in orderly mountains, the assemblies are ready for immediate shipment. It would take a 20-car freight train to transport a 1,000 bed hospital; the

Biggest news in 10 years of business data processing!

Only DATAmatic 1000 with ORTHOTRONIC CONTROL re-creates lost or damaged data instantaneously... without human aid, without reprocessing

Today, all modern computers feature elaborate self-checking systems which detect errors before they can slip through. But correction of these errors takes time.

Only DATAmatic 1000 with ORTHOTRONIC CONTROL can now detect *and correct* these errors automatically in 1/20th of a second.

This seemingly impossible achievement is the latest contribution of Honeywell research, a force which has already rocketed DATAmatic 1000 many years ahead in business data processing.

Coupled with DATAmatic 1000's acknowledged superiority in every aspect of reliability, ORTHOTRONIC CONTROL now insures uninterrupted accuracy throughout the processing cycle. Information which has been lost or damaged by any cause whatsoever is literally re-created in its original, correct form. Where other systems would stop and "ask" for human assistance, ORTHOTRONIC CONTROL takes over, does what needs to be done and keeps DATAmatic 1000 humming right along at record-breaking speeds.

This self-correcting ability has an obvious impact on the profit potential of any data processing application. It eliminates unproductive machine time, vastly multiplying the economic advantages already enjoyed by users of DATAmatic 1000.

Along with such exclusive features as "frequency modulation" recording, 3-inch wide magnetic tape, multi-tape searching modes and dozens of other scientific *firsts*, ORTHOTRONIC CONTROL enables DATAmatic 1000 to set still higher standards of performance in terms of processing speed, capacity, reliability and versatility.

If your company is considering an electronic data processing system, don't make a move until you've investigated DATAmatic 1000 with ORTHOTRONIC CONTROL.

Write for technical bulletin and full details. DATAmatic Division, Dept. A-10, Newton Highlands 61, Massachusetts.

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ELECTRONIC DATA PROCESSING

hospital unit can be loaded and leaving the depot in a few hours after requisitioning.

Smaller items or smaller quantities of supplies are prepared for shipment in the Loose Issue Section — the "world's largest drugstore." Other duties performed in this section include: the cleaning, renovating, and packaging of surgical instruments; storage of biologicals, some of which are kept in one of the largest refrigerators in the world; and vault storage for precious metals and narcotics.

One of the main problems in using the RAMAC in the Louisville Medical Depot was randomizing the Federal Stock Numbers. They consist of eleven digits, but cover only 16,400 items in all. The disk storage unit of the RAMAC consists of 50 ferrous oxide coated 24 inch diameter metal disks. Slightly separated, these disks are mounted on a vertical shaft and revolve at 1200 revolutions per minute while in operation. Information is stored in the form of magnetized spots in tracks around the disks. There are 100 concentric tracks on each disk. These disks provide storage for a total of 5,000,000 single digit characters. The address arm is directed to a record by means of a five digit number. The first two digits are the disk number, the next two are track number, and the final digit is the location on the track.

The ideal situation would be to have 5 digit stock numbers to correspond with the file addresses. But this is not feasible, so a method of reducing or converting the 11 digit Federal Stock Number to a file address was required. This was accomplished by the internal programming of a formula to randomize the stock numbers, as follows:

1. Start with Federal Stock Number 65054326943
2. Drop group and class: 4326943
3. Add first 3 Federal Item Identification Numbers digits to the low order positions: $4326943 + 432 = 4327375$
4. Square result: 4327375×4327375, equals 107261743906625.
5. Read out center 4 digits: 1743
6. Multiply by number of allotted disks: $1743 \times .20$, equals 0548.60
7. Interpret as: Item is located on disk 05 track 48

The track is laid out as follows:

RECORD 0; RECORD 1; RECORD 2; RECORD 3; and so forth up to 9.

RECORD 0 is laid out as follows:

SECTOR 0	SECTOR 1	SECTOR 2	SECTOR 3
0549	5054326894	5054326943	5207214834

and so forth

By seeking and reading address 05480 the access arm will go to disk 05 track 48 and read record 0 (index) to a processing track.

Sector 1 is compared with the last 10 digits of the Federal Stock Number; if this does not compare, sector 2 is compared. On each comparison the access arm moves to the record corresponding with the sector being compared. In this example sector 2 compares, and so the access arm is at record 2 or address 05482. This item record is then read to a processing track, and Federal Stock Number is compared with the Federal Stock Number of the input card.

The access arm will remain at this address during the updating of this item record so that another "seek" operation is not required to return the record to file.

In randomizing stock numbers, it can be seen that there is a possibility of more than 9 Federal Item Identification Numbers which could have the address of 05480. When this occurs the digit 1 is added to the second low order position of the address 05480 changing it to 05490. This modified address is then stored in sector 0 of record 0 track 48. The modified address is then sent to the address register and the process repeated for address 05490.

RECORD 0 indicates the overflow address:

SECTOR 0	SECTOR 1	and so forth
0549	5054326894	

Of the 16,400 records stored, the number of overflows is very small.

HIGHWAY CONSTRUCTION FUND ANALYSIS ON AN AUTOMATIC COMPUTER

Arnold D. Palley

John Diebold and Associates
New York, N.Y.

THE ROAD BUILDING program of the Kentucky State Department of Highways has a complex problem in funding. Information must be produced that controls the five funds participating in road construction: (1) Federal aid, (2) a special $100,000,000 bond issue voted to match Federal aid, (3) state road fund revenue from gasoline and other road-user taxes, (4) a special "rural secondary" fund for construction of county and feeder roads, and (5) cost-sharing by cities, railroads and other miscellaneous outside participants. Two to four of these funds may be involved in any project, with varying ratios of participation, and with a great variety of special restrictions on alloting, earning, and billing the funds.

John Diebold and Associates, Inc., consultants in automatic data processing, and Griffenhagen & Associates, specialists in public administration and finance, have together produced a program run on an IBM 650 leading to complete operating and long-range analysis of this complex funding problem. Prior to installation of the computer program, the funds were accounted for and controlled largely by methods of approximation, but with a tremendous sudden increase in construction volume the possible errors of approximation threatened to be in the millions. The alternatives were either forming and training a large staff of accountants and clerks or using the computer to recognize the method to be used for each kind of expenditure and to do all the necessary calculations.

A complication of the problem was that expenditures on a given project arise from six possible different construction or design phases, with different contractors of state organizations handling each one. These phases are: Construction contracts; Utilities movement contracts; Right-of-Way acquisition; Location work by state forces; Demolition contracts; and Engineering supervision of construction. Between 500 and 1000 projects may be currently active. Funding ratios and special restrictions may vary on each phase within a given project. As many as five contractors or state units may be engaged on any one phase.

The job of producing a detailed statement of fund

participation for each contract, phase, project, project budget account, and general ledger account, is completed in three hours of computer time and five hours of tabulating machine time. Input to the program consists of three kinds of card: (1) a Participation Master Card, which identifies the funds sharing in the cost, the sharing ratio, and special restrictions, (2) liability cards, showing the total amount obligated, increases, and decreases, and (3) expenditure cards. Cards (2) and (3) are available as part of the normal machine accounting process. Since the information on card (1) may change from month to month it was necessary to establish a strict clerical control to insure accuracy. The run is now made monthly, but with the installation of an IBM 650 Tape-RAM system of integrated accounting planned for 1959, all project information will be updated on RAM records as soon as any transaction occurs.

An example of the type of output produced is the report of the position of Federal Aid funds. Each month the computer tells us, for each phase, contract, and project budget account (1) the amount of Federal funds obligated, (2) Federal Aid earnings, that is the share of expenditures that may be billed, (3) Federal Aid earnings that cannot, because of regulatory restrictions, be collected until some later date, and (4) the remaining Federal Aid liability. This same basic information is produced for all participating funds.

Operating costs of the system are approximately $1300 yearly. It is highly unlikely that similar results could be obtained without a computer but with a minimum staff and machine expenditure of $25,000 a year. The value of current and correct project funding information to fiscal and budgetary control and planning is inestimable. To mention one benefit — the information produced will prevent the possible loss of hundreds of thousands of dollars in otherwise unidentified or undistributed project costs.

The program was designed by Hugh J. Reber of Griffenhagen & Associates, and the author; the programming work was done by Christine E. Lammers of John Diebold and Associates.

TRUCK MAINTENANCE COSTS OBTAINED USING AN AUTOMATIC COMPUTER

Eve Peasner

The Datics Corp.
Fort Worth, Texas

ONE OF THE chief factors determining optimum replacement of motor vehicles is the maintenance cost. Although many other variables affect maintenance costs, age and mileage are probably the two most significant. These were the factors considered in statistical studies made by The Datics Corporation for an electric utility company.

Two complete tables were developed by Datics — one to predict maintenance costs for passenger vehicles and the other for utility trucks. These tables were statistically tested and found to represent actual performance reliably. For example, a four-year-old passenger vehicle registering an average of 12,000 miles per year can be expected to cost $384.00 for maintenance during its fifth year of operation. A similar four-year-old utility truck can be expected to cost $561.00 in repair bills during its fifth year.

Original data collected on the fleet indicated the type of vehicle (passenger or truck), age of vehicle, accumulated mileage, and accumulated maintenance costs. Although many other factors influence fleet maintenance costs (driving conditions, type of terrain, make and model of vehicle, etc.), a correlation was needed which would not be too complicated for practical use. All extraneous variables were lumped into one portion of the prediction labeled "unexplained variation." This unexplained variation was expected, and minimized in the results of the final regression equation.

A trial and error method for evaluating various forms of a regression equation was used to predict the original data. The study was conducted in a step-wise manner. Using the final results, the computer predicted quite well accumulated maintenance costs for vehicles of different ages and mileages. The resulting tables now in use are simple to interpret and easy to refer to as one of the factors determining whether or not to replace a given vehicle.

REDUCTION OF INVENTORY BY DATA PROCESSING MACHINES

THE ALASKA COMMUNICATION System (ACS) is operated by the Army Signal Corps, and handles all military and private communication between Alaska and the United States.

The ACS operates 11,508 miles of radio circuits, 9,308 miles of open wire lines, and 1,466 miles of submarine cable. The system ties in directly with the recently established DEW and White Alice networks to form a link in the North American defense complex, interconnecting remote Canadian and Alaskan radar outposts, airfields, guided missile sites, and military bases.

Recently, the mission of the ACS was changed from primarily a military mission to include the mission of providing long distance telephone and telegraph service to the public. In line with this change in mission, the ACS has been reviewing and streamlining its operations consistent with sound commercial operating practices.

In one year, the ACS has successfully reduced a huge inventory of supplies necessary to maintain its communication network and the 1,000 officers and men on duty at ACS stations from Ketchikan to Point Barrow. A year ago, this inventory numbered more than 16,000 separate items, ranging from transformers and radar tubes to rubber bands and paper pads.

Employing a tight system of inventory control and a battery of IBM accounting machines, the ACS as of July 1, 1958, had reduced its inventory of supplies from $4,000,000 to less than $1,000,000, a 75 per cent reduction in one year's time. The number of separate items needed to be kept in its Seattle warehouse was reduced by almost half, from 16,000 to 9,000.

A COMPUTER AS A SPACE TRAFFIC POLICEMAN

A COMPLEX COMPUTER and radar system acts as a "space traffic policeman" during the firing of ballistic missiles, both with and without "satellites." The system is used at the Patrick Air Force Base, Florida.

As the missile lifts from its concrete firing pad, eight ground radar antennas, part of the tracking system "Azusa," follow its upward flight. Radar signal pulses are reflected from the missile back to the radar antenna. Radar equipment determines the position and velocity

of the missile by noting the length of time the signal takes to return to the ground installation.

The radar data feeds into an IBM 704 computer housed in a blockhouse within sight of the firing pad. Every ten seconds the computer determines the exact point where the missile would land if the thrust of the rocket engines were to fail.

Output from the computer is relayed by cable to a central operation room where a range safety officer watches the flight, and also watches a large map of the firing range where the computer graphically plots the missile's path and computes points of impact. On the map lines indicate safety limits of the firing range. If the computer indicates an impact point for the missile outside the range limits, the safety officer presses the "destroy" button detonating an explosive charge in the missile. If on the other hand, a successful launching occurs, the computer then determines the timing for releasing the successive stages, including the third stage for sending a satellite into orbit. In the release of the third stage of a satellite missile, the system indicates the correct positioning for obtaining the balance between thrust and gravitational pull to reach a successful orbit.

The electronic system for predicting point of impact protects range personnel and nearby communities. Because of the speed of the missile and the relatively short time in which a decision must be made, the system must be both accurate and rapid as it tracks and plots the missile's position. The IBM 704 computer provides 20,000 calculations a second, and checks its own accuracy at the same time.

The multiple data transmission and computing technique has been used for the IGY Vanguard and Jupiter C Explorer experiments at the missile range of the Air Force Missile Test Center.

LEAST-COST FEED FORMULATION USING ELECTRONIC COMPUTERS

W. A. O'Brien

The Service Bureau Corp. (SBC)
New York, N.Y.

IN THE LAST several years millions of dollars have been spent on the development of better livestock feeds. These new feeds, which are providing a scientific blend of ingredients selected to contain certain amounts of desirable nutrients, result in better development of animals and improved production of meat, eggs and milk.

Feed production has rapidly evolved into a highly automated and scientific industry. The products of this industry have enabled livestock raisers and animal products growers to market their products weeks earlier, increase their production, and improve quality. Although many of the newer feeds are more costly than their counterparts used formerly, the resulting increased production has advanced at a faster rate than the cost. The production per pound of feed is now far greater than it was even a few years ago.

To produce this new efficiency in livestock feed, many Federal and State government agencies, universities, and private organizations engage in continuing research in the problems of feed formulation. New developments mean improved production and livestock producers are being alerted to every advance.

To supply these new feeds, the livestock feed manufacturing industry, encompassing some 6,000 mills throughout the country, is continuously searching for better, more efficient methods of production. Already highly automated in their production departments, many of these companies are turning to the latest tools and techniques for feed formulation analysis. A typical mill, for example, may at various times produce from ten to fifty or more different feed mixes to provide their customers with the required variations in nutritional values. In blending these feeds, the mill uses from ten to twenty-five different ingredients such as corn, barley, oats, soybean meal, fish meal, bone meal. Each ingredient has a different nutritional composition. Bran, for example, contains about 16% protein, 6% ash, 3% fat, 11% fiber, .1% calcium; alfalfa meal contains about 17% protein, 10% ash, 2% fat, etc. A feed formula may have the following nutritional requirement: at least 10 milligrams of niacin per pound, 6% fat, a maximum of 4% fiber, a minimum of 34% but no more than 37% protein, exactly 5.5% calcium, at least 7,000 USP units of vitamin A, and so forth.

To complicate the problem further, each of the ingredients used has a different cost. The problem, then, not only is to determine the ingredients to be used, but also the exact proportions of each to result in the lowest possible total cost. Other complications result from the fact that certain ingredients cannot be used beyond limits because the over-all unfamiliar color of the feed might result in buyer resistance. Or, use of some ingredients beyond certain limits would make it impractical to pelletize the feed, which may be the desired packaging form.

The construction of a "least cost" formula under such conditions is highly complex. In the past, the feed producer's nutritionist and his staff have devoted a considerable part of their valuable time in performing thousands of routine calculations.

To assist the nutritionist in this task, a few large feed producers several years ago began to program their electronic calculators, particularly the IBM 650, to calculate least-cost formulas by the application of linear programming techniques. Much of the advanced research in this field was carried on by universities, notably by Oklahoma State University.

At first, use of the electronic computer feed formulation was limited to those large companies having sufficient volume to justify economically the full-time installation of their own electronic computer.

Computer technicians at SBC, however, working with basic linear programming and industry nutritional experts, have developed IBM 650 programs that now make this powerful new technique available to every feed producer, regardless of size.

Standard formats have been developed to record source data and detailed explanation sheets cover all instructions for submitting data.

Answers produced by the IBM 650 in every case will be at least as efficient as the formulas now being used in any problem and may result in very significant savings. Early users of SBC feed formulation calculations achieved a saving of as high as $3.00 per ton over their former costs. Yet, for a mill producing six to ten tons of feed per hour, a saving of $1.00 per ton would be nothing short of startling.

Computers and Data Processing— Current Talks

I. Railway Systems and Procedures Association, October 7-9, Morrison Hotel, Chicago, Ill.

"CLIC" — C & O's Car Location Information Center / A description of CLIC and how it works. Transportation and Traffic men relate numerous resulting benefits which have been realized by patrons, operations, transportation and traffic / K. T. Reed, General Supt. Transportation, Chesapeake & Ohio Railway; D. S. Bradley, General Supt. Computer Applications, Chesapeake & Ohio Railway; C. R. Sargent, Asst. Freight Traffic Manager, Chesapeake & Ohio Railway; W. E. Mason, Freight Service Manager, Chesapeake & Ohio Railway.

A Better Tool to Provide the Shipping Public, Traffic Offices, and Car Service Bureau with Car Location Information / Rock Island's unique electronic car data processing system provides for rapid receipt and distribution of vital information on car movements. Information is made instantly available to all Rock Island traffic representatives, both on and off line points. In some cases, they can know the location of a car almost as soon as its train's caboose clears the yard / T. E. Drury, Asst. General Auditor, Chicago, Rock Island & Pacific RR.

How can you make Realistic Freight Schedules? / Can better schedules increase business? Better train performance will put money in the till by reducing operating expense and improving your competitive position. Pennsylvania tells how train performance and locomotive tonnage ratings are calculated by digital computers / J. E. Hogan, Electrical Engineering Dept., Pennsylvania Railroad.

General Foods — Survey Approach to Electronics / How General Foods uses electronic equipment, including Ramac 305 to provide: A basis for management decisions; Analysis of transportation costs; Shipping patterns; Payroll and accounts receivable / B. N. Clune, Director of Administration & Methods Planning, General Foods Corporation.

Can Electronics Help You Manage Account 712? / Keeping material and supplies on hand runs into real money. The U.S. Army Signal Corps tells how to create a system that will reduce inventory and give you increased availability of supplies. Can your Accounting, Purchase—Stores people apply these techniques on your road? / Joseph L. Gurmankin, Asst. to Deputy for Integrated Data Processing, U.S. Army Signal Supply Agency.

Integrated Accounting with Conventional Equipment / Dollar savings can be effected with conventional equipment. Operating expense accounting is particularly amenable to the use of prepunched cards and mark-sensing. The principal source documents in punched card form are integrated to produce early expense reporting. Details in the reports facilitate cost control and budgetary accounting. Here is how D. T. I., T. P. & W. and the W. M. handle: Material stock records, inventory; Reporting of departmental operating efficiency; Standard costs / J. C. Meisner, Aud. of Machine Accounting, Detroit, Toledo & Ironton R.R.; C. L. Pattison, Vice President-Secretary & Compt., Toledo, Peoria & Western R.R.; B. E. Wynne, Controller, Western Maryland Railway.

Is it Time to Revise Your Freight Accounting Procedures? / Medium and large scale computers are being used to modernize freight accounting procedures / W. R. Donaldson, Auditor of Computer Accounting, Southern Railway System; R. J. Helfman, Asst. Auditor Mechanized Accts., Northern Pacific Railway; E. Mech, Auditor Freight Receipts, Illinois Central R.R.

How Can Passenger Accounting be Performed by Electronic Computers? / Southern Railway will describe a new procedure for accomplishing passenger accounting which utilizes the IBM 705 / W. R. Donaldson, Auditor of Computer Accounting, Southern Railway System.

Can You Use Today's Newer Payroll Procedures? / How the IBM 607, IBM 650 and Univac are used for payroll, labor distribution, governmental reports and data for managerial use in control of labor costs. Computer learning techniques improves maintenance of equipment payroll distribution / R. E. Griffin, Panel Moderator, Asst. Auditor Data Processing, Univac, Great Northern Railway Co.; A. M. Handwerker, Auditor Disbursements, Chicago & Northwestern Railway Co.; Warren L. Dufour, Programmer, Univac, Great Northern Railway; Mr. A. A. Mackey, Mgr. Data Processing Services, Canadian National Railways; J. T. Ford, Auditor of Expenditures, Chesapeake & Ohio Railway.

II. National Simulation Conference, October 23-25, 1958, Statler-Hilton Hotel, Dallas, Texas.

Thursday October 23

1. Operational Analog Simulation of the Vibration and Flutter of a Rectangular Multicellular Structure / A. Ben Clymer, North American Aviation, Inc. (Columbus).
2. Distributed Parameter Vibration With Structural Damping and Noise Excitation / Robert Powell, Jet Propulsion Laboratory, Calif. Institute of Technology.
3. A Non-Real-Time Simulation of SAGE Tracking and BOMARC Guidance / D. W. Ladd and E. W. Wolf, Lincoln Laboratory, Mass. Institute of Technology.
4. Liquid Transfer and Storage System Simulation by Active Element

Computers / R. D. Miller and R. K. Engel, Convair (Ft. Worth).

5. Z-forms, and the Digital Simulation of Dynamics — V. Azgapetian, Servomechanisms, Inc.
6. Some Aircraft Problems Simulated by Means of Z-forms / R. Boxer, Servomechanisms, Inc.
7. A New Technique in System Performance Evaluation / W. J. Nemerever, Boeing Airplane Co.
8. Linear Approximation by Differential Analyzer Simulation of Orthonormal Approximating Functions / E. G. Gilbert, University of Michigan.
9. Solution of Convolution Integrals by Analog Computers / F. E. Brammer, Case Institute of Technology.

Friday, October 24

10. Some Applications of a High-Speed Analog Correlator / V. C. Rideout, University of Wisconsin.
11. A Time-Multiplexing Technique / E. Rawdin, Radio Corp. of America (Moorestown).
12. A Method for Helicopter Rotor Performance Simulation / W. G. Heffron and T. R. Bristow, Melpar, Inc.
13. A Perturbation Technique for Analog Computers / Leon R. Bush and P. J. Orlando, Cornell Aeronautical Laboratory, Inc.
14. Standard Simulation Circuits / H. L. Ehlers, Autonetics Division of North American Aviation, Inc.
15. The Design of Position and Velocity Servos for Multiplying and Function Generation / Edward O. Gilbert, University of Michigan.
16. The Card Programmed Diode Function Generator / R. A. Sinker, Electrol, Inc.
17. Multiplier Circuits Utilizing Squaring Property of a Triangular Wave / D. W. C. Shen, University of Pennsylvania.
18. A Four Quadrant Multiplier Using Triangular Waves, Diodes, Resistors, and Operational Amplifiers / Paul E. Pfeiffer, The Rice Institute.
19. General Purpose DC Analog Computer With Transistor Circuitry / H. L. Ehlers, Autonetics Division of North American Aviation, Inc.

Saturday, October 25

20. Simulation to Obtain a Systems Measure of an Air-Duel Environment / Alan B. Pritsker, Roger C. Van Buskirk, and John K. Wetherbee, Battelle Memorial Institute.
21. Extending the Bandwidth of Precision Analog Systems / E. M. Billinghurst and C. H. Single, Beckman, Berkeley Division.
22. Generalized Integration on the Analog Computer / George A. Bekey and Wallace H. Whittier, Ramo-Wooldridge Corp. and Beckman Computation Center.
23. Transistorized Relay Amplifier / Robert Bruns and James Wilcher, Jet Propulsion Laboratory, Calif. Institute of Technology.
24. Airborne Radar-Beacon Traffic Simulator / S. J. Neshyba and R. R. Coffman, Convair (Ft. Worth).
25. Optimization by Random Search on the Analog Computer / John K. Munson and Arthur I. Rubin, E. I. du Pont de Nemours & Co. and Electronic Associates, Inc.
26. Computer Systems for Jet Transport Simulators / Edward G. Schwarm, Link Aviation, Inc.
27. APPR-1 Simulator Description / E. L. Morrison, Jr., RCA Service Co. (Camden).
28. A Technique for Absolute Measurement of Analog Computer Capacitors / W. C. Meilander and B. H. Hellman, Goodyear Aircraft Corp.
29. A Comparison of Techniques for Simulating the Flow of Discrete Objects / D. L. Gerlough, Institute of Transportation & Traffic Engrg., University of Calif. at Los Angeles.

III. Computer Applications Symposium, sponsored by the Armour Research Foundation, October 29-30, Morrison Hotel, Chicago, Ill.

Wednesday, October 29

Operations Research and the Automation of Banking Procedures / R. A. Byerly, Director of Research, National Association of Bank Auditors and Comptrollers.

Information Systems Modernization in the Air Materiel Command (Univac 1105, IBM 709) / D. E. Ellett, Colonel, USAF, Chief, Data Development Division, Directorate of Plans and Programs, Headquarters, Air Materiel Command.

Utilization of Computers for Information Retrieval / Ascher Opler, Consultant, Computer Usage Company.

Problems and Prospects of Data Processing for Defense / C. A. Phillips, Director, Data Systems Research Staff, Office of the Assistant Secretary of Defense (Comptroller).

An Integrated Data-processing System with Remote Input and Output (NCR 304) / R. D. Whisler, Systems and Audit Manager, S. C. Johnson and Sons, Inc.

The Role of Character Recognition Devices in Data-processing Systems / R. L. Harrell, Director of Electronics Processing, The Reader's Digest Association.

Input-Output, Key or Bottleneck? / R. D. Elbourn, Chief, Components and Techniques Section, Data Processing Systems Division, National Bureau of Standards, U.S. Department of Commerce.

Thursday, October 30

Scientific Uses of a Medium-Scale Computer with Extensive Accessory Features (IBM 650) / Richard A. Haertle, Supervisor, Engineering Mathematics Group, AC Spark Plug Division, General Motors Corporation.

Optimizing Designs with Computers / D. D. McCracken, Associate Research Scientist, Institute of Mathematical Sciences, New York University.

Computer Applications in the Numerical Control of Machine Tools / R. B. Clegg, Engineer, Servo Machine Tool Division, Kearney & Trecker Corporation.

Frontiers in Computer Technology / R. W. Hamming, Member of the Technical Staff, Bell Telephone Laboratories.

Computer Sharing by a Group of Consulting Engineering Firms (Bendix G-15D) / E. M. Chastain, President, and J. Mc Call, General Manager, Midwest Computer Service, Inc.

Current Developments in Computer Programming Techniques (IBM 650, Univac I) / Frederick Way, III, Assistant Director, Computing Center, Case Institute of Technology.

The Future of Automatic Programming (Univac 1103A, IBM 704) / Walter F. Bauer, Director, Computation and Data Reduction Center, Space Technology Laboratories.

Social Responsibility of Computer Scientists—Oct. 1958 Round-up

I.

DEVIATION FROM A PATTERN OF NORMAL COMMON SENSE AND THE COMMON LAWS GOVERNING THE COMMUNITY CLIMATE

L. J. Rogers

South Charleston, W. Va.

I TAKE ISSUE with the editorial of April 1958 concerning "The Social Responsibilities of Computer Scientists" on two counts: the approach to the problem and some suggested answers. In the first place, it seems naïve to imply that because one is a "computer scientist," he has some exceptional qualities setting him apart from the rest of the world so that many important things wouldn't function without him. Moreover, the notion that he somehow possesses exceptional qualifications to solve general social ills or further the lot of mankind in areas *other than computers* is not based on reality.

My real quarrel however is with some of the startling propositions advanced, to wit: "A computer scientist can refuse to do what he thinks is wrong, and accept the consequences of doing what he thinks is right, harsh though they may be." This is completely wrong and irresponsible advice. It is literal anarchy and a total disregard of the fruits of thousands of years of civilization which includes a society based on law, respect, and mutual cooperation. The scientist cannot lay claim to any social responsibility by espousing behavior setting him above the common laws governing the community climate.

A propos: "Certainly, work on computing systems for spreading poison gas effectively will not lead to more happiness for human beings generally." A seemingly worthy proposal, it does not bear up under close scrutiny. I believe we are at war with barbarians who would bury us; therefore this hypothetical computer would rank high on a good American's priority list. The close coupling of the two successive thoughts ". . . a computer scientist can refuse to do what he thinks is wrong . . ." with ". . . work on computing systems for spreading poison gas effectively . . ." is an unfortunate coincidence for the Forum column. It appears to call for a "strike" against a hypothetical call by this country's government to aid in perfecting defensive weapons for its survival. Hardly an assumption of social responsibility!

I believe we have strayed from objectivity in the manner of fulfilling social responsibilities when we departed from urging vocal representation by computer scientists along *with other people* in the normal outlets for expressing opinions: the trade journals, newspapers, P.T.A., Congress, or what have you. Specialists are traditionally reticent, and this is indeed unfortunate. Besides making their opinions known, they also have an additional responsibility to their country in encouraging young people to become interested in science. This they could do by direct appeal and by serving as models of intelligent, loyal, and industrious citizens in their community.

In short, the computer scientist should take advantage of the normal outlets of expression (which he has not seriously done in the past), but should not do so with the assumption that he is especially endowed merely because of his specialized technical training. Deviation from a pattern of normal common sense will simply add fuel to the already prevalent (and justified?) "anti-intellectual" notions held by the people and under which unfortunately scientists fall in general. How about the responsibility to rectify that feeling?

II.

"PEACE GAMES" TO BE ANALYZED BY COMPUTER

John H. Davenport

Levittown, N.Y.

I DO NOT think that your columns should be used to discuss the social responsibilities of computer scientists. Considered as computer scientists, they have no social responsibilities. Considered as citizens, there is no need to discuss their social responsibilities; they may affirm or deny or ignore them — but what is there to discuss? Such responsibilities exist.

On the other hand, I think it would be perfectly legitimate to devote considerable space to technical applications of computer science to the various social problems confronting us in our time. Mr. Macdonald's article (May, 1958, "An Attempt to Apply Logic and Common Sense to the Social Responsibility of Computer Scientists") mentioned applications to the economic recession and to child guidance and development. I should be far more interested in the application of computer techniques to the problem of human survival in the world of anarchic nation states in which we live.

IBM's NORC as you doubtless know is already being used in war games by the Department of Defense, and has for some years been so used. But I should like to have some of your readers apply themselves to the use of computers in what may be called for lack of a better term "peace games." The basic problem to be solved in a war game, as I understand it, is how to maintain maximum national power in any given situation vis-à-vis any other nation or group of nations. A primitive formulation of the basic problem to be solved in a "peace game" would be: "What action or combination of actions by whom would result in the maximum welfare for the human race?" As citizens, your computer scientists are probably capable of commencing on this kind of project immediately, the state of the so-called social sciences being what it is, without waiting for the collaboration of such "experts," though of course the social scientists will be very useful later on in the solutions of the problem, to supply quantitative input data rather than qualitative or operational factors.

As a citizen I would certainly be very happy to collaborate with some of your readers who are interested in this problem, in collating and defining some of the operational factors in world politics to make them suitable for handling by a computer.

III.

BUTCHER KNIVES AND DYNAMITE

Tom Garnett

New York, N.Y.

I THINK THAT you should discuss the social repercussions of computer science. Unless we all work together to cut the "Defense" budget to zero, we will suddenly find that there is no further need for computers. Like butcher

knives and dynamite, computers can be used for good or evil purposes.

It is up to all of us, by discussion and careful thought, to see to it that computers are used for peaceful and constructive purposes.

IV.

HORROR AND FREEDOM

Morton M. Astrahan

San Jose, Calif.

IN REGARD TO the editorial entitled "Cooperation in Horror" in the February issue, I agree with your statements concerning the type of articles that will not be published in **Computers and Automation.** However on the subject of a horror point, I can't see that poison gas is any more horrible than a thermo-nuclear bomb. Yet, I feel that if we unilaterally stopped the development of this weapon, we might not now have the freedom to write editorials in magazines as we wish. To stop the plunge towards world-wide destruction will require a two-sided agreement.

V.

THERE IS INDEED A HORROR POINT

Milton H. Aronson

Editor, Instruments and Automation
Pittsburgh, Pa.

THANK YOU FOR reminding your readers that there is indeed a "horror point" beyond which a human being cannot go and remain human. You show a sense of editorial responsibility that is as much needed as it is lacking today in our country. As another editor, of technical publications, I congratulate you.

VI.

AGAINST ALL ENEMIES, FOREIGN AND DOMESTIC

Hanson W. Baldwin

(excerpts from an article "French Army Loyalty" in the *New York Times*, May 30, 1958)

THE PROBLEMS OF conflicting loyalties and of the limitations of soldierly obedience are implicit in the French crisis . . . The German and Japanese war crime trials involved these issues, and now the French soldier of all ranks must determine his higher loyalty and define the limits of obedience.

The determination of who and what to obey is never easy in a crisis that shakes the social and political systems and military structure of a nation. . . . Some German officers, particularly those who participated in the bomb plot against Hitler, came to feel that their highest loyalty was not to Hitler but to Germany.

. . . The United States military man promises to "support and defend the Constitution of the United States against all enemies, foreign and domestic." . . . The French Army was split during World War II, principally between Vichyites and Free French . . . The "private conscience" of a French soldier could dictate a rebellion either against "the generals and officers set over me," or against the politically constituted authority as the soldier interprets it. . . .

VII.

AN EFFORT TO UNDERSTAND WHAT THEY ARE DOING AND WHY THEY ARE DOING IT

Rabbi Louis Finkelstein

New York, N.Y.

(excerpts from an article "The Businessman's Moral Failure" in the September, 1958, issue of *Fortune* Magazine)

. . . TOO MANY BUSINESSMEN never stop to ponder what they are doing; they . . . worry about their place on the economic ladder, but are not concerned sufficiently with whether the civilization in which they work is likely to collapse. They can defeat a local competitor, but may well be defeated by the competitor of us all which is moral decay. . . . Our American tragedy is that we fail to see the signs of our decay. But the signs are apparent in the vulgar ostentation all around us, in the demoralization of American captives in the Korean war, in the widespread defiance of law. The signs are apparent in our general toleration of wrongdoing, which is itself an evil and corrupting force. . . .

We hear of businessmen using wire taps to obtain information about their competitors, of management acting in collusion with racketeers, of men using prostitution to promote the sale of their goods, of businessmen profiting from rat-infested tenements. . . .

Men as individuals and as corporations must make an effort to understand what they are doing, and why they are doing it. The first step in the ethical life is self-criticism . . . we have to feel the wonder and significance of life and its unique opportunity for achievement. Each of us has only one life on earth. When that life is used unwisely, the loss is irreparable, for oneself and one's fellows. . . .

VIII.

ACM COMMITTEE ON SR

ON JUNE 11, at the meeting of the Council of the Association for Computing Machinery in Urbana, Ill., as a result of a proposal to the Council by E. C. Berkeley, the president of the association was authorized to appoint a committee to consider "the social responsibilities of computer people to advance socially desirable applications of computers and to help prevent socially undesirable applications."

The members of the Association appointed to the committee are: Saul Gorn, Chairman, Philadelphia; Arvid Jacobson, Detroit; Melvin Shader, White Plains, N.Y.; and Edmund C. Berkeley, Newtonville, Mass.

In connection with the work of this committee, it is of course desirable to hear from as many computer persons as possible as to their views on this subject.

Readers' and Editor's Forum

[Continued from page 6]

"Modern Computers — Objectives, Designs, and Applications." The topics on which papers have been submitted and are being considered are:

- Modern System Objectives
- Solid State Computers
- Novel Component Designs
- Automated System Design
- Modern Computer Technology
- Modern Data Processing
- Artificial Intelligence Designs
- Application of Simulation Techniques
- Social Science Applications
- Perception and Recognition Designs
- Novel Programming Developments
- Proven Business Applications

Computer Services Survey
(Supplement)

Neil Macdonald
Assistant Editor, Computers and Automation

This supplement provides nine more entries to be added to the 31 entries published in the July issue.

The editors will be glad to receive additional entries so that the "Computing Services Survey" may be made still more complete and brought up to date in future issues of **Computers and Automation.** The reply form (which may be copied on any piece of paper) follows:

1. Brief description of the quantity and types of computing machines and equipment which you have ....
....
....
2. Brief description of the types of computing problems which you specialize in ....
....
....
3. Number of employees..........
4. Year established..........
5. Any remarks? (attach paper if needed) ....
....
....

Filled in by.......... Title..........
Organization ....
Address ....
....

When this is completed, please send it with your literature to
Computers and Automation
815 Washington Street
Newtonville 60, Mass.

Each entry is in the form: Name and address of organization / EQPM: Brief description of quantity and types of computing machines and equipment which organization has / PROB: Types of computing problems which the organization specializes in / Number of employees, Year established. Abbreviations: s — size in number of employees, e — year established, S — small or short time ago, M — medium, L — large or long time ago.

Alwac Corp., Computer Div., El-Tronics, Inc., 13040 South Cerise Ave., Hawthorne, Calif. / EQPM: ALWAC III-E Digital Computer System containing the buffered punched card system, the buffered magnetic tape complex, and the buffered punched paper tape equipment / PROB: production of punched tape for numerically controlled machine tools (NUCOP), performance of department store unit control, simple and multiple correlations, heat conduction on a solid body, carrying charge computations for retail credit companies, payroll and labor distribution, electromechanical relay design; data reduction of various sorts, including rocket test stand, gas turbines, flight test, etc., human rescue conditions, trajectory analysis, computer circuit design / Ms(30) ?e

Alwac Corp., Computer Div., El-Tronics, Inc., 10 Columbus Circle, New York 19, N.Y. / EQPM: ALWAC III-E data processing system with usual complement of peripheral equipment for punched card and paper tape input-output / PROB: all problems involving business data processing and scientific computation / Ss(10) Se (1957)

Beckman Instruments, Inc., Berkeley Div., Los Angeles Computation Center, 305 Parkman Ave., Los Angeles 26, Calif. / EQPM: 2 EASE control consoles, one with 100 amplifiers, the other with 60 amplifiers; auxiliary equipment includes approximately 300 automatically set coefficient potentiometers, 30 high speed electronic multipliers; also equipped with the DO/IT (digital output input translator) which permits control of the computer from a Flexowriter and punched tape / PROB: aircraft and missile simulation, chemical reactor simulation, heat and vibration studies, non-linear control system simulation, nuclear reactor simulation, power distribution calculations, wind tunnel control system analysis and other problems relating to the aircraft, chemical, electrical power distribution and nuclear reactor fields / Ss(4) Se(1957)

Brender and Brender Inc., 35449 Annapolis St., P.O. Box 712, Wayne, Mich. / EQPM: Royal Precision LGP-30 / PROB: civil engineering applications / Ss(9)

Le(1957, computing service; 1916, business)

The Fluor Corp., Ltd., Box 510, Whittier, Calif. / EQPM: Datatron 205 paper tape input and output floating point / PROB: scientific and engineering programming service and machine rental / Ss(10) Se(1956)

The Franklin Institute, Benjamin Franklin Parkway at 20th St., Philadelphia 3, Pa. / EQPM: Univac I, Unityper II's, Univac High Speed Printer, Uniprinter, 80-column card-to-tape converter, Electronic Associates PACE Analog computer, Sampled-Data Simulator and Computer (SADSAC) / PROB: one-shot and recurrent data processing applications, scientific and business types, dynamical systems, heat transfer problems / Ms(40) Se(1951)

Mannix Co., Ltd., Computer Service Centre, 737 8th Ave., West, Calgary, Alberta / EQPM: LGP 30 / PROB: Petroleum engineering, civil engineering, statistics, petroleum economics / Ss(4) Se(1958)

Mexico, National University of Mexico, Dept. of Scientific Research Coordination, University City, Mexico, D.F., Mexico / EQPM: IBM 650, auxiliary data processing equipment / PROB: economic research and computing services for governmental institutions and private enterprises; scientific, engineering and technological problems / Ss(8) Se(1958)

Rand Corp., Numerical Analysis Dept., 1700 Main St., Santa Monica, Calif. / EQPM: IBM 704 with 32,768 words of core storage, associated peripheral equipment, punch card equipment / PROB: general practitioners in the computing field / Ms(80 in computing center) Me(1948)

BOOKS and OTHER PUBLICATIONS

(List published in COMPUTERS and AUTOMATION, Vol. 7, No. 10, October, 1958.)

WE PUBLISH HERE citations and brief reviews of books, articles, papers, and other publica-

MANUSCRIPTS

WE ARE interested in articles, papers, reference information, and discussion relating to computers and automation. To be considered for any particular issue, the manuscript should be in our hands by the first of the preceding month.

ARTICLES: We desire to publish articles that are factual, useful, understandable, and interesting to many kinds of people engaged in one part or another of the field of computers and automation. In this audience are many people who have expert knowledge of some part of the field, but who are laymen in other parts of it.

Consequently, a writer should seek to explain his subject, and show its context and significance. He should define unfamiliar terms, or use them in a way that makes their meaning unmistakable. He should identify unfamiliar persons with a few words. He should use examples, details, comparisons, analogies, etc., whenever they may help readers to understand a difficult point. He should give data supporting his argument and evidence for his assertions.

We look particularly for articles that explore ideas in the field of computers and automation, and their applications and implications. An article may certainly be controversial if the subject is discussed reason ably. Ordinarily, the length should be 1000 to 3000 words. A suggestion for an article should be submitted to us before too much work is done.

TECHNICAL PAPERS: Many of the foregoing requirements for articles do not necessarily apply to technical papers. Undefined technical terms, unfamiliar assumptions, mathematics, circuit diagrams, etc., may be entirely appropriate. Topics interesting probably to only a few people are acceptable.

REFERENCE INFORMATION: We desire to print or reprint reference information: lists, rosters, abstracts, bibliographies, etc., of use to computer people. We are interested in making arrangements for systematic publication from time to time of such information, with other people besides our own staff. Anyone who would like to take the responsibility for a type of reference information should write us.

NEWS AND DISCUSSION: We desire to print news, brief discussions, arguments, announcements, letters, etc., anything, in fact, if it is not advertising and is likely to be of substantial interest to computer people.

PAYMENTS: In many cases, we make small token payments for articles and papers, if the author wishes to be paid. The rate is ordinarily ½c a word, the maximum is $15, and both depend on length in words, whether printed before, whether article or paper, etc.

All suggestions, manuscripts, and inquiries about editorial material should be addressed to: *The Editor,* COMPUTERS *and* AUTOMATION, *815 Washington Street, Newtonville 60, Mass.*

tions which have a significant relation to computers, data processing, and automation, and which have come to our attention. We shall be glad to report other information in future lists if a review copy is sent to us. The plan of each entry is: author or editor / title / publisher or issuer / date, publication process, number of pages, price or its equivalent / comments. If you write to a publisher or issuer, we would appreciate your mentioning **Computers and Automation.**

Alt, Franz L. / Electronic Digital Computers: Their Use in Science and Engineering / Academic Press Inc., 111 Fifth Ave., New York 3, N.Y. / 1958, printed, 336 pp. $10.00.

The author of this book is the editor of the *Journal of the Association for Computing Machinery* and Assistant Chief of the Applied Mathematics Division of the National Bureau of Standards. The book has five parts: Introduction; Automatic Digital Computers; Coding and Programming; Problem Analysis; Matching Problems and Machines; and is volume 4 of the "Applied Mathematics and Mechanics Series" of Academic Press, prepared under the auspices of the Applied Physics Laboratory of Johns Hopkins University. The book is written for scientists and engineers, with advanced mathematical training, but contains much useful and important information for many other readers.

Condon, E. U., and Hugh Odishaw, editors, and about 70 specialists / Handbook of Physics / McGraw-Hill Book Co., Inc., 330 West 42 St., New York 36, N.Y. / 1958, printed, 1504 pp., $25.00.

This is a magnificent book, a comprehensive and authoritative treasurehouse of basic physics. There are nine parts: mathematics; mechanics of particles and rigid bodies; mechanics of deformable bodies; electricity and magnetism; heat and thermodynamics; optics; atomic physics; the solid state; nuclear physics. The book gives answers to thousands of questions about both classical and modern physics. In Part 1 pages 7 to 9 refer briefly to computing machines; but physicists putting problems on computing machines will find much help throughout this book. In Part 5, page 3, paragraph 2, line 6, the words "one gram of" have been incorrectly omitted.

Reinfeld, Nyles V. and Vogel, Wm. R. / Mathematical Programming / Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N.Y. / 1958, printed, 274 pp., $9.00.

This book is devoted to a collection of practical, and interesting applications and examples and a practical approach for management men, to the subject of Mathematical Programming (or Linear Programming as it is alternatively called). Appendices deal with the theory behind the method. The book is based on wide teaching of industrial personnel average industrial managers,

Shera, Jesse H., Allen Kent, and James W. Perry / Information Resources: A Challenge to American Science and Industry / The Western Reserve University Press, distributed by Interscience Publishers Inc., 250 Fifth Ave., New York, N.Y. / 1958, photo-offset, 214 pp., $5.00.

"Information Resources" is based upon the proceedings of a special meeting of the Council on Documentation Research held February 3-4, 1958, at Western Reserve University, Cleveland, Ohio. The material of the text is dealt with in four parts; Part One discusses a plan for creating a "National Center for the Coordination of Scientific and Technical Information"; Part Two descrbes the current status of information services and recognized needs in the field; Part Three presents a summary of the meeting and the resulting program of action; Part Four contains ten appendices concerning the meeting agenda, abstracting and indexing services, literature searching machines and systems, etc.

Robeson, P., Jr., ed. / Russian-English Glossary of Electronics and Physics / Consultants Bureau, Inc., 227 West 17th St., New York 11, N.Y. / 1957, photo-offset, 354 pp., $10.00.

The *Russian-English Glossary of Electronics and Physics* attempts to supply a comprehensive dictionary of contemporary Russian terminology in these fields so that American readers can better understand the material included in Soviet scientific journals currently available in the United States. Terms included in the glossary were chosen from the pages of recent issues of such journals. Appendices include Soviet vacuum tube specifications, U.S. unit and tube equivalents, circuit components, circuit notation and abbreviations.

Proceedings of the Symposium "New Computers — A Report from the Manufacturers" / Association for Computing Machinery, 2 East 63rd St., New York 21, N.Y. / 1957, photo-offset, 132 pp., $2.50.

This reports a symposium sponsored by the Los Angeles Chapter of the Association for Computing Machinery, March 1, 1957. It contains eleven papers including nine which describe nine advanced computers, including the NCR 304 (National Cash Register), the Datatron system, the Datamatic 1000, the Bizmac II (RCA), the X308 Computer (Remington Rand), the IBM Stretch Computer, the IBM 709, the Philco S-2000, the Alwac Model 800. Four of these systems are especially useful for large-scale business data processing; five are intended especially for scientific data processing. Improvements still needed in the computer field are considered in the "Closing Remarks" by John W. Carr III, especially in computer storage capabilities and programming procedures.

O'Connor, John J. / Information Retrieval by Univac and by Univac-Produced Non-Mechanized System, Part I / Remington-Rand Univac Division of Sperry Rand Corp., Philadelphia, Pennsylvania / 1957, photo-offset, 95 pp., limited distribution.

This is a report of research on methods of recovery of information from large files: "It has been established that much if not all recovery of relevant information from large files can be mechanized and thereby often made efficient and complete." The report describes alternative ways of using a Univac for recovering information, gives formulas for the number of storage tapes required and for the search times, and discusses many important concepts from symbolic logic and other fields pertaining to searching.

Anshen, M., C. C. Holt, F. Modigliani, J. F. Muth, and H. A. Simon / Mathematics For Production Scheduling / Reprint from the March-April 1958 issue of "The Harvard Business Review," Soldiers Field, Boston 63, Mass. / 1958, printed, 12 pp., $1.00.

This article reports some of the findings of a group study carried out by members of an Office of Naval Research project on the planning and control of industrial operations in order to reduce guess work and increase efficiency. They sought to apply mathematical techniques to the scheduling of production and employment. In a paint manufacturing plant of 100 employees, a comparison of actual performance and the performance that would have been realized with the new technique indicated a cost advantage of 8.5% for the mathematical decision rule; and this percent translated into an annual saving of $51,000.

Beyer, R. T., and A. O. Williams, Jr. / College Physics / Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N.Y. / 1957, printed, 660 pp., $8.00.

The authors intend this as a text for a one-year liberal-arts college course in general physics. They emphasize that a student must understand the basic principles of physics, rather than simply memorize physical facts and laws, if he is to attain any ability to apply such principles. Also, the authors believe physics must be studied "in its context of modern thought, activity and accomplishment." Some preliminary attention is devoted to the science's historical development and present status. Kinematics, the laws of dynamics, acoustics, thermodynamics, electrostatics, electronics, nuclear physics are among the many topics included in the 31 chapters. The last chapter is "The Physicist in Modern Society." Problems and further references on each topic accompany each chapter discussion. Useful tables are included in appendices.

ADVERTISING INDEX

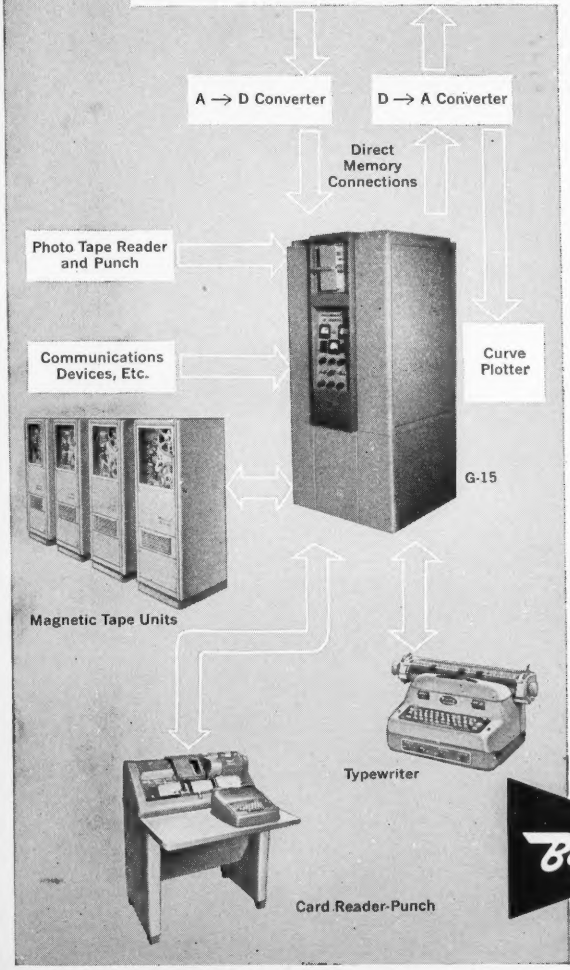
Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency if any.

Bendix G-15

the ideal computer for "on-line" data processing and control

TYPICAL SYSTEMS WHERE THE G-15 CAN BE USED

1. *Process controls*
2. *Missile tracking and impact prediction systems*
3. *Engine test stand data reduction and control*
4. *Wind tunnel data reduction and control*
5. *Real time position determination for mobile missile launching sites*
6. *Machine tool controls and many other open and closed loop systems*



In use *now*, as a part of several systems, the Bendix G-15 has proven itself the ideal digital computer for data reduction and control. Its high speed...versatile command structure... widely varied methods and means of input and output... small physical size...and its low cost, all contribute to the ***reason*** why the G-15 is being selected for use in more and more on-line applications.

The G-15 is the fastest general purpose computer in the low price field. For real-time control applications, this speed is often important. In at least one case the G-15 has been chosen for real-time computation where only a million dollar computer has ever been used before.

The versatility of the G-15's basic programming system contributes heavily to its ability in on-line applications. Commands are available for shifting with tally, extracting and assembling of words, overflow indication, branching, block data transfer, and many other special functions valuable in on-line use.

Perhaps of greatest importance is the computer's unique variety of input-output possibilities. The basic G-15 includes an electric typewriter for input-output and control, as well as a paper tape punch and magazine loaded high-speed photoelectric tape reader. Punched card, and magnetic tape units are available and all may be connected at the same time through the computer's buffered input-output registers.

Other devices such as A to D or D to A converters may be connected simultaneously or in place of the above mentioned accessories, and operated under control of the computer.

Finally, information can be directly written on or read from the memory drum, under control of special external devices.

Note that all of these methods of input and output can be utilized without any modification of the computer. Connectors are provided on the rear of the G-15 for each type of input and output described.

If ruggedness is required, the G-15 can prove an enviable record. Two of them have been in use for well over a year bolted directly to the deck of a ship, and have shown a performance record to be envied by any computer based on solid ground. During a recent six months period the average up-time for all of the over 100 Bendix G-15's in the field was 95.4%.

The G-15 is compact, too, occupying just six square feet of floor space. Of course, it can be used as a powerful general purpose computer, as well as for on-line applications. A variety of simplified programming systems is available, including the renowned INTERCOM 1000, which can be used after four hours training or less.

The reasons are many...but the fact is that more and more G-15's are being leased or purchased for on-line use. If you would like to discuss your own requirements, we would be pleased to work with you. Write Department D-7 for information.

If you are going to the ISA show, our specialists and the G-15 will be there in booths 1440-1541.

Bendix Computer

DIVISION OF BENDIX AVIATION CORPORATION
LOS ANGELES 45, CALIFORNIA

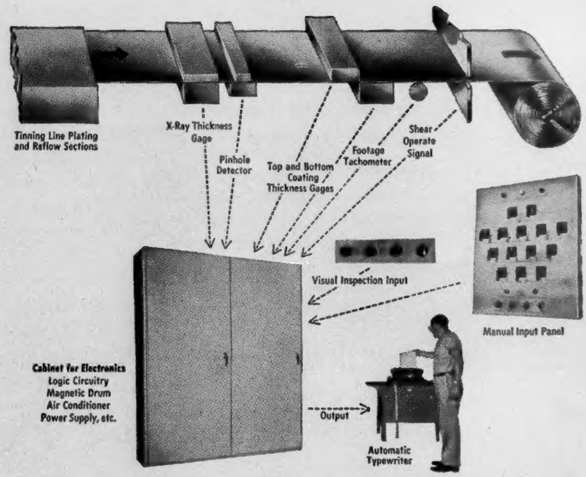
OPERATION up turn Buy now for extra values GENERAL ELECTRIC

COMPUTER PROGRESS

Digital and Analog Computers at Work

ARTICLE 3 VOLUME 1

SOLVING A TINPLATE INSPECTION AND BILLING PROBLEM WITH MODULAR COMPONENTS

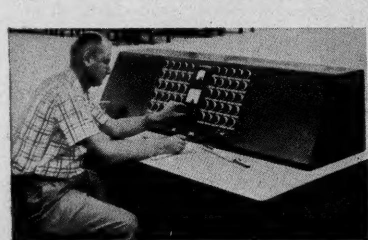


The trend towards purchasing tinplate direct in large coils rather than in sheets brings about a change in inspection techniques. No longer is it possible to separately inspect each sheet; instead, inspection must now be done at line speed on the delivery end of the tinning line. As complete coils of tinplate will now be shipped to the customer, steel companies will need permanent, accurate defect records.

General Electric is now solving this problem for several tinplate producers by *automating* their data logging with the new Model 302 Automatic Inspection Data Accumulator for Tinplate. This system provides a complete, typewritten record for quality control and billing purposes immediately upon completion of each coil.

Unlike many computers installed in factories, the G-E Data Accumulator is designed specifically for an industrial environment, not for office use. Modular electronic units are mounted on strong, 3/16 inch metal frames in completely enclosed cabinets. The all-transistorized plastic coated printed circuit plug-in cards are easy to repair; maintenance costs are reduced since cards may be re-used, and spare parts stock is kept small.

In addition, an exclusive new magnetic drum application cuts out approximately 60% of previously required electronic gear. Not only does the reduction in complexity increase reliability, but the space and dollar saving also allows sufficient duplication of circuitry for constant cross-comparison of data. Preventive maintenance can be performed on one section while the other continues to log data. Magnetic storage also eliminates the danger of losing stored data if power fails.



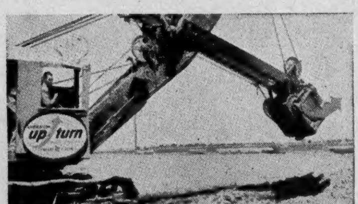
ONLY 8 HOURS INSTRUCTION REQUIRED TO OPERATE PRODUCTION SCHEDULING COMPUTER

The new G-E 306 desk-size analog computer, designed to solve office and factory production and business problems, can be operated by the average clerical worker after only 8 hours instruction.

The computer is used wherever multiplication of a number by each of fifty coefficients and the summing of the results is required. Up to twenty-four such numbers may be multiplied with one setting of dials. Manufacturing problems such as production scheduling, materials explosion and work station load impact studies, as well as business problems like budget syntheses and operating reports (or any other first order linear equation problem) may be solved.

A typical solution takes only 2 minutes. The unit operates on 115 volts.

COMPUTER DEPARTMENT LAUNCHES OPERATION UPTURN WITH NEW MILLION-DOLLAR PLANT IN PHOENIX, ARIZONA



General Manager H. R. Oldfield, Jr., is pictured at the controls of the Operation Upturn steam shovel which recently broke ground for the new 104,000 square foot permanent plant which is expected to be completed by December of 1958.

"Our business is good and getting better," Oldfield said. "We're going to continue to expand during the year, adding perhaps a hundred or more people." The department now has over 800 employees.

The 160 acre site is located in Deer Valley Park, northwest of Phoenix along the west side of the Black Canyon Highway and south of the intersection with Thunderbird Road.

For more information, contact your nearest General Electric Apparatus Sales Office, or Computer Department—Room 102, General Electric Company, 1103 No. Central Avenue, Phoenix, Ariz.

CPA—9

Progress Is Our Most Important Product

GENERAL ELECTRIC